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PERFORMANCE COMPARISON OF ROUTING PROTOCOLS USED FOR WIRELESS COMMUNICATION

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ABSTRACT

A mobile ad hoc network (MANETs), which is work like mesh topology hence it is also called as mesh network. (MANET) is a self-configured wireless network of mobile devices. The Ad hoc networks are networks do not require any fixed infrastructure. The aim of ad hoc network is to provide communication in such areas where there is limited or no existing infrastructure is available. Instead, hosts are connected with each other to keep the network connected. ''ad-hoc'' network topologies, allowing people and devices to use existing wireless networks. Recent trends in wireless communications have been expanding from cellular networks (1G and 2G) to new integrated services like (3G and 4G). Routing is core problem in networking to deliver data from node to node. These recent evolutions have been generating a renewed and growing interest in the research and development of MANET. Manet protocol used in the Ad hock networks or in wireless networks. This paper is on the Comparison of the protocols used in Manet for satisfactory operation.

KEYWORDS: Adhoc Networks, AODV, DSR, MANET, TORA

INTRODUCTION

Mobile Ad-hoc Networks (MANETs) are wireless networks which consist of A collection of two or more devices equipped and networking capability. 'Ad-hoc' Latin word means 'for this' or for this only. Entirely of mobile nodes that communicate on-the-move without base stations. (MANETs) Supports anytime and anywhere.(MANETs) is a self-organizing and adaptive allows spontaneous formation and deformation of networks. Wireless networks are a new technology that will allow users to access information and services electronically, regardless of their Geographic position. Each mobile station acts like router.(MANETs) support peer to peer communication.ad hock network removes administrative cost and it is very easy for deployment. Nodes in these networks will handle traffic and carry out network control and routing protocols. While designing of higher level protocols such as routing and implementing applications with quality of service problem occurs like higher error rate, collision interference, and bandwidth. Sometimes Manet is also called as infrastructure less networking since it doesn't require any type of infrastructure. Some examples are possible use of ad-hock network includes students using laptop computers to participate in interactive lectures. Business associates to share information during meetings.

HISTORY OF MANETS

70's

- U.S. started a research project to interconnect the tactical units deployed in areas of military conflict without requiring the presence of a fixed network.
- The project, called PRNET (Packet Radio Network), used a combination of ALOHA and CSMA protocols, combined with a Distance Vector Algorithm.

80's

- Evolved into SURAN (Survivable Adaptive Radio Network), uses hierarchical routing protocol Link State Algorithm.

90's

- IETF created MANET working group, looking for standardizing the relevant aspects of ad hoc networks to use in commercial applications.

00's

- Was created the Ad Hoc Network Consortium in Japan, aiming to unite the interests and efforts of industry.

10's

- Nowadays, it is using in many projects, especially where we cannot have a fixed infrastructure.

ROUTING PROTOCOLS

Routing protocol is needed for transmission of packet from source to destination via number of nodes. So many routing protocols are used for such transmission in adhoc networks. These protocols are set up a route for packet delivery to be a correct destination. Routing protocols are classified in three types as 1) Table driven also called as proactive routing protocol 2) On-Demand also called as reactive routing protocol 3) Hybrid routing protocol.

Table-Driven (Proactive Routing Protocols)

This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. Each node keeps one or more routing table containing information about routing of other nodes present in the network. All nodes are updating its table to maintain consistent and up-to-date view of the network. When network topology changes the nodes will propagate update massage throughout the network to maintain routing table and up-to-date view of the network. These routing protocols route the packets from each node to every other node in the network. In this type of routing protocols routs are ready to use instaneously. Some table driven routing protocols are DSDV, WRP, CGSR, OLSR, STAR, FSR, HSR, and GSR.

On-Demand (Reactive Routing Protocols)

As compared with table driven routing protocols each node does not maintain all up-to-date routes. Instead of routes are created whenever required. Whenever source want to send packets to destination it follows some connection establishment techniques and set a route from source to destination. Such type of route is available till the destination is

reachable. Hence the protocols do not exchange routing information periodically. Some of the routing protocols used under this are DSR, AODV, TORA, ABR, SSA, FORP, and PLBR.

Hybrid Routing Protocols

This type of protocol combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. Nodes within certain distance of concerned node or within a geographical area are said to be a within routing zone of the given node. For routing within zone the table driven routing is used and outside the region on demand routing is used. Protocols used in this category are CEDAR, ZRP, and ZHLS.

This paper is for comparison of more suited on-demand routing protocols used in Manet for wireless communication such as DSR, AODV, and TORA.

DSR (DYNAMIC SOURCE ROUTING)

Dynamic source routing protocol (DSR) is an on-demand routing protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence. The basic approach of this protocol (and all other on-demand routing protocols) during the route construction phase is to establish a route by flooding Route Request packets in the network. The destination node, on receiving a Route Request packet, responds by sending a Route Reply packet back to the source, which carries the route traversed by the Route Request packet received.

DSR Route Discovery Equations

Source Node broadcast Route Request packets. Each neighbor will check if it received this request before or if its ID is in the list. If yes it will drop the packet. If not it will append its ID to the packet and rebroadcast the packet again. Route request contains the destination address, source address, and unique identification number. Consider a source node that does not have a route to the destination. When it has data packets to be sent to that destination, it initiates a Route Request packet. This Route Request is flooded throughout the network. Each node, upon receiving a Route Request packet, rebroadcasts the packet to its neighbors if it has not forwarded it already, provided that the node is not the destination node and that the packet's time (TTL) counter has not been exceeded. Each Route Request carries a sequence number generated by the source node and the path it has traversed. A node, upon receiving a Route Request packet, checks the sequence number on the packet before forwarding it. The packet is forwarded only if it is not a duplicate Route Request. The sequence number on the packet is used to prevent loop formations and to avoid multiple transmissions of the same Route Request by an intermediate node that receives it through multiple paths. Thus, all nodes except the destination forward a Route Request packet during the route construction phase. A destination node, after receiving the first Route Request packet, replies to the source node through the reverse path the Route Request packet had traversed. Nodes can also learn about the neighboring routes traversed by data packets if operated in the promiscuous mode (the mode of operation in which a node can receive the packets that are neither broadcast nor addressed to itself). This route cache is also used during the route construction phase.

DSR Route Maintenance

The node that discovers the failure link will send Route Error to the Source. When the source gets the Route Error Packet it will delete the path from the cache and will find another route in its cache, if it didn't find any route it will run Route Request again.

Advantages and Disadvantages

This protocol uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. In a reactive (on-demand) approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead. The disadvantage of this protocol is that the route maintenance mechanism does not locally repair a broken link. Stale route cache information could also result in inconsistencies during the route reconstruction phase. The connection setup delay is higher than in table-driven protocols. Even though the protocol performs well in static and low-mobility environments, the performance degrades rapidly with increasing mobility. Also, considerable routing overhead is involved due to the source-routing mechanism employed in DSR. This routing overhead is directly proportional to the path length.

AODV (AD HOC ON-DEMAND DISTANCE VECTOR ROUTING)

In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats. Much of the complexity of the protocol is to lower the number of messages to conserve the capacity of the network. For example, each request for a route has a sequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on. Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request. The advantage of AODV is that it creates no extra traffic for communication along existing links. Also, distance vector routing is simple, and doesn't require much memory or calculation. However AODV requires more time to establish a connection, and the initial communication to establish a route is heavier than some other approaches.

AODV– Route Discovery

Source Node broadcast Route Request packet to established connection between source node and destination node. Each 1.intermediate node gets a Route Request do the following steps: 2.Establish a reverse link to node it received the Route Request from 3.If request received before from another node then the request will be discarded. If route to destination is available and up-to-date then return Route Reply using the reverse link. Otherwise rebroadcast the Route Request. From source to destination again.

AODV – Route Maintenance

When a link is broken due to movement of nodes or any other reason The node that discover the failure link will send Route Error to the Source node. When the source gets the Route Error Packet it will delete the path from the cache and will find another route in its cache, if it didn't find any route it will run Route Request again.

Advantages and Disadvantages

The main advantage of this protocol is having routes established on demand and that destination sequence numbers are applied to find the latest route to the destination. The connection setup delay is lower. One disadvantage of this protocol is that intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries. Also, multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead. Another disadvantage of AODV is unnecessary bandwidth consumption due to periodic beaconing.

TEMPORALLY ORDERED ROUTING PROTOCOL (TORA)

The TORA attempts to achieve a high degree of scalability using a "flat", non-hierarchical routing algorithm. In its operation the algorithm attempts to suppress, to the greatest extent possible, the generation of far-reaching control message propagation. In order to achieve this, the TORA does not use a shortest path solution, an approach which is unusual for routing algorithms of this type. TORA builds and maintains a Directed Acyclic Graph DAG rooted at a destination. No two nodes may have the same height. Information may flow from nodes with higher heights to nodes with lower heights. Information can therefore be thought of as a fluid that may only flow downhill. By maintaining a set of totally-ordered heights at all times, TORA achieves loop-free multipath routing, as information cannot 'flow uphill' and so cross back on itself. The key design concept of TORA is localization of control messages to a very small set of nodes near the occurrence of a topological change. To accomplish this, nodes need to maintain the routing information about adjacent (one hop) nodes. Timing is an important factor for TORA because the height metric is dependent on the logical time of the link failure. TORA's route erasure phase is essentially involving flooding a broadcast clear packet (CLR) throughout the network to erase invalid routes.

TORA – Route Discovery

A node which requires a link to a destination because it has no downstream neighbors for it sends a QRY (query) packet and sets its (formerly unset) route-required flag. A QRY packet contains the destination id of the node a route is sought to. The reply to a query is called an update UPD packet. It contains the height quintuple of the neighbor node answering to a query and the destination field which tells for which destination the update was meant for. A node receiving a QRY packet does one of the following: 1.If its route required flag is set, this means that it doesn't have to forward the QRY, because it has already issued a QRY for the destination, but better discard it to prevent message overhead. 2. If the node has no downstream links and the route-required flag was not set, it sets its route-required flag and rebroadcasts the QRY message.

TORA – Route Maintenance

Triggered when the last link towards the destination is lost and then Adjust Height Level and propagate through the network. In the network the links are reversed to reflect the changes in the route. If there found any invalid route then

route deletion is flooded to delete invalid routes. When a node has detected a partition it sets its height and the heights of all its neighbors for the destination in its table to NULL and it issues a CLR (Clear) packet. The CLR packet consists of the reflected reference level and the destination id. If a node receives a CLR packet and the reference level matches its own reference level it sets all heights of the neighbors and its own for the destination to NULL and broadcasts the CLR packet. If the reference level doesn't match its own it just sets the heights of the neighbors its table matching the reflected reference level to NULL and updates their link status.

COMPARISON TABLE OF REACTIVE ROUTING PROTOCOLS

Table 1

Protocols ⟹ / Parameters ⇓	DSR	AODV	TORA
Unidirectional/Bidirectional links	Supports both the links	Supports only bidirectional links	Supports only bidirectional links.
Multicasting	No	Yes	No
Routing scheme	Flat	Flat	Flat
Multiple routes	Yes	No	No
Type	Source routing	Distance vector	Link reversal
Overall complexity	moderate	moderate	high
Routes maintained	Cache	Table	Table
Security	none	none	none
Periodic broadcast	No	May be	May be
Loop	No	No	Yes
Expiry of routing information	Possible	Not possible	Not possible.
Packet delivery in low traffic	High	High	High
Packet delivery in high traffic	Average	Average	Low

CONCLUSIONS

In this paper several routing protocols for adhoc networks for wireless communication is discussed. Two categories of routing protocol were discussed. Table-driven and on-demand routing protocols. In table driven routing protocols each node maintain its routing table and in on-demand routing protocol route is developed when source want to send packet from source to destination. The tables above describe the important parameters of protocol for robust and steady performance of routing protocol of Manet.

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